

Appendix J
USCG Dry Cargo Sweepings Scientific
Investigation: Identification of Sonar
Investigation Sites

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TO: U.S. Coast Guard

FROM: CH2M HILL

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This memorandum provides documentation of the process used to identify sweeping zones for side-scan sonar investigation and mapping for the U.S. Coast Guard Dry Cargo Sweepings Impact Analysis Project – Task 5 Historical Deposition Analysis (Volpe et al., 2006). Sonar investigation zones were identified for Lake Superior, Michigan, and Erie. As described below, these zones were developed based upon the density of historical shipping routes, material associated with the sweepings, information gleaned from Lake Carrier Association (LCA) interviews, and other sweeping information (U.S. Coast Guard, 2002; U.S. Coast Guard, 2005).

Introduction

Side-scan sonar data collection for mapping occurred primarily on U.S. Coast Guard vessels in and around bulk cargo shipping lanes with known high density of historical sweeping activities in the Great Lakes. Sonar readings were collected for sites on Lake Superior, Lake Michigan, and Lake Erie. The purpose of the study was to document the occurrence (if any) and characterize deposition patterns of dry cargo sweepings that had accumulated on the lake bottom from historic sweepings activities. The focus was on areas of reported sweepings activities in Lakes Erie, Michigan and Superior. In comparison to these lakes, Lakes Huron and Ontario had limited dry cargo loading and unloading and were not selected for sonar analysis.

This memorandum summarizes the historical sweepings locations and sweeping material types to more accurately target potential historical sweepings locations during the lake bottom sonar mapping. The sonar findings will in turn aid the U.S. Coast Guard in efforts to assess whether dry cargo sweepings practices have significant environmental impacts and ultimately develop a policy for dry cargo sweepings management. The dry cargo sweepings types selected for detailed analysis based on the Scientific Approach (Volpe et al., 2006) were western coal, eastern coal, limestone, and taconite pellets. The results of the mapping will also be used to select sites for sediment sampling during the spring 2007 field investigation.

Geographic Information System Historical Data Analysis

Historical sweepings data documentation included the starting and ending coordinates of dry cargo sweepings for the 2004 shipping season as logged by U.S. flagged vessels. This data set was obtained and plotted onto geographic information system (GIS) digitized navigation maps. This data set had been compiled during the previous investigations supporting the U.S. Coast Guard rule making (U.S. Coast Guard, 2005). Areas with high

densities of sweepings for each of the target sweeping types were then selected for sonar investigation. Consideration was also given to the predominant material discharged in each lake to increase the likelihood that each of the selected sweepings types (coal, taconite, and limestone) would be observed.

During the analysis of Lake Erie data, it became apparent that a significant volume of shipping in the area was conducted by Canadian flag vessels. To provide a better characterization of sweeping in Lake Erie, an additional data set prepared as part of *A Study of Dry Cargo Residue Discharges in the Great Lakes* (U.S. Coast Guard, 2002) was obtained. This additional data set provided sweepings information from the 2001 shipping season and included Canadian flagged vessels. It was used to supplement the 2005 U.S. Coast Guard data for only the Lake Erie analysis.

Lake Superior

Selection Criteria

Historical information indicates that iron ore and coal are the predominant cargo loaded in the study area. GIS data mapping shows that Duluth (Figure 1) is a high traffic loading port for coal and taconite shipments, and Silver Bay (Figure 2) loads a high volume of taconite. Coal shipped from Duluth is primarily western coal. Coal shipments in Lake Erie are predominantly eastern coal, which could have a different chemical composition.

Zone Location

Figures 1 and 2 illustrate the two potential investigation zones for Lake Superior. The high concentration of sweepings occurrences, combined with the overlap of LCA track line routes out of Duluth and Silver Bay, provide a high level of confidence that sweepings occur in these areas. Verbal discussions with the LCA also indicate that the route out of Duluth is a high traffic area. These two locations were consequently chosen as side scan sonar investigation locations. Coordinates in decimal degrees of the two study areas were as follows:

Western Coal Area

LONG. -91.878759, LAT. 46.830218; LONG. -91.432217, LAT. 46.985741
LONG. -91.874684, LAT. 46.818140; LONG. -91.426470, LAT. 46.968938

Taconite Area

LONG. -90.850466, LAT. 47.323964; LONG. -90.427784, LAT. 47.370171
LONG. -90.850466, LAT. 47.315631; LONG. -90.427371, LAT. 47.356631

Lake Michigan

Selection Criteria

Historical information indicates that coal is the predominant cargo loaded in the Lake Michigan area. As can be seen in Figure 3, the majority of coal sweeping occurs along Track 15 leaving Calumet Harbor. The primary investigation zone was selected to sample in this area.

A supplementary route encompassing the confluence of several shipping lanes into or out of multiple Lake Michigan ports were selected for sampling in case additional ship time was

available after data gathering in the primary study area. While the 2005 U.S. Coast Guard report did not indicate significant sweepings occurred in 2004 within this area, this confluence of shipping lanes appeared to be a good high-density ship traffic location for evidence of older sweepings (pre-sweepings restrictions).

Zone Location

Figure 3 illustrates the two potential investigation zones for Lake Michigan. The primary zone was the larger and more northerly zone. The secondary zone was the smaller zone. Coordinates in decimal degrees of the two study areas were as follows:

Primary Coal Area

LONG. -87.1978, LAT. 42.4999; LONG. -87.1762, LAT. 42.4999
LONG. -87.3746, LAT. 42.0261; LONG. -87.3558, LAT. 42.0190

Secondary Coal Area

LONG. -87.4542, LAT. 41.8506; LONG. -87.4347, LAT. 41.8486
LONG. -87.4661, LAT. 41.7933; LONG. -87.4468, LAT. 41.7941
LONG. -87.4618, LAT. 41.7354; LONG. -87.4425, LAT. 41.7362

Lake Erie

Selection Criteria

Historical information indicates that coal and stone are the predominant cargo loaded in the Lake Erie area. However, the original data set obtained for the 2004 shipping season in the e²M report shown in Figure 4 (U.S. vessels only) did not show a significant volume of coal shipping. Further research confirmed that the ports of Ashtabula, Conneaut, and Toledo are significant coal shippers; however, a significant volume of the coal was shipped on Canadian flag vessels. To better characterize actual sweeping patterns in Lake Erie, data from the 2001 shipping season for both U.S. and Canadian flag vessels (U.S. Coast Guard, 2002) were obtained and plotted. This additional data set provided additional insight into Lake Erie shipping and sweeping locations and provided greater consistency with patterns documented in the prior studies.

Figure 5 includes sweepings data from both the 2004 shipping season (U.S. vessels) and the 2001 shipping season (Canadian and U.S. vessels). From this plot, three potential study zones were identified. The primary zone was selected to identify sweepings from ships leaving Ashtabula loaded primarily with coal. The identified zone contains a high volume of sweepings with similar starting points within a relatively narrow track. There is not an official navigation route from Ashtabula headed westward, so the sonar study target area relied solely on the 2 years of sweepings data to determine a location.

A secondary zone was selected to identify stone sweepings from ships traveling between Sandusky and Cleveland. Sandusky (Marblehead) is a known location for limestone shipping. Figure 5 identifies several reported sweepings in this path. To confirm the selection of this zone, the raw data set was reviewed and additional sweepings between these cities were identified that did not have specific coordinates associated with the data.

A third zone was selected to identify coal sweepings from ships leaving the port of Conneaut. Conneaut is another port known for shipping coal. This zone also contained a

high volume of coal sweepings; however, the sweepings encompassed a wider area. There is not an official navigation route from Conneaut headed westward, so the sonar study target area relied solely on the 2 years of sweepings data to determine a location. This third area was selected in case ship time was available after data gathering in the primary and secondary study areas.

Zone Location

Figure 5 illustrates the three potential investigation zones for Lake Erie. The primary zone was the central zone. The secondary zone was the southwest zone. A third tertiary zone was located farther east in case ship time and weather conditions allowed for additional data collection. Coordinates of the three study areas were as follows:

Primary Coal Area

LONG.-81 58' 2.22", LAT. 41 51' 37.10"; LONG.-81 28' 20.00", LAT. 41 53' 46.05"
LONG.-81 57' 51.17", LAT. 41 50' 31.04"; LONG.-81 28' 27.75", LAT. 41 52' 38.24"

Secondary Stone Area

LONG.-82 40' 53.08", LAT. 41 34' 19.18"; LONG.-82 22' 55.63", LAT. 41 33' 43.74"
LONG.-82 40' 57.33", LAT. 41 33' 21.06"; LONG.-82 22' 58.47", LAT. 41 32' 45.62"

Tertiary Coal Area

LONG.-80 50' 8.24", LAT. 42 8' 46.94"; LONG.-80 45' 44.69", LAT. 42 9' 33.89"
LONG.-80 48' 39.75", LAT. 42 4' 43.39"; LONG.-80 44' 33.44", LAT. 42 5' 33.49"

Conclusions

For each lake, zones of heavy sweeping activities were identified. To the extent logistics permitted, each of the zones was mapped with multi-beam side scan sonar to identify the presence/absence and relative density of sweepings within the sediment. In addition, to the extent logistics permitted, possible areas of dense sweepings were videoed and sediment/deposited sweepings sampled for visual inspection.

References

U.S. Coast Guard. 2002. "A Study of Dry Cargo Residue Discharges in the Great Lakes." Prepared for the U.S. Coast Guard, Office of Operating and Environmental Standards (G-MSO), Environmental Standards Division (G-MSO-4). Washington, D.C.

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